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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/712,195	11/13/2003	David Ross Graham	06446 USA	8277

23543 7590 11/30/2005

AIR PRODUCTS AND CHEMICALS, INC.
PATENT DEPARTMENT
7201 HAMILTON BOULEVARD
ALLENTOWN, PA 181951501

EXAMINER

VANOY, TIMOTHY C

ART UNIT	PAPER NUMBER
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1754

DATE MAILED: 11/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/712,195

Applicant(s)

GRAHAM ET AL.

Examiner

Timothy C. Vanoy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 14-16, 26 and 31 is/are allowed.
- 6) ☒ Claim(s) 1-13, 17-25, 27-30 and 32-41 is/are rejected.
- 7) ☐ Claim(s) 4, 19 and 29 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 04/07/2005.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Claim Objections

- a) Claim 4 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 4 improperly broadens the Markush group recited in claim 3 by including the provision of a "vessel".
- b) Claim 29 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 29 improperly broadens the Markush group recited in claim 28 by including the provision of a "vessel".
- c) Claim 19 is objected to because ammonia is not considered to be a solution.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

- a) Claims 11, 20, 21, 22, 38 and 39 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. It is critical or essential to the practice of the invention, for either the claims or the specification to provide specific examples of the "promoter" mentioned in claims 11, 20, 21, 22, 38 and 39, but neither

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the claims or the specification provide any specific examples of the claimed "promoter".

The definition of "promoter" set forth on pg. 9 lines 6 and 7 in the applicants' specification that it is an initiator or catalyst only raise the question of which initiators and which catalysts are contemplated by the inventors. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976).

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 6, 18, 19, 22, 27, 36 and 39 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- a) Claim 1 does not particularly point out and distinctly set forth the means for generating hydrogen gas as set forth in the preamble of the claim. The invention of claim 1 only sets forth an apparatus comprising a chemical hydride storage compartment and a hydrogen storage compartment, but the preamble of claim 1 sets forth that the invention generates hydrogen gas. So where are the limitations directed to the generation of hydrogen gas set forth in claim 1?
- b) Claim 6 does not particularly point out and distinctly set forth how the "aluminum metal", "magnesium metal" and "magnesium/iron alloys" can be considered to be hydrides because they lack atomic hydrogen in their chemical composition.

Likewise, claim 27 does not particularly point out and distinctly set forth how the members of the Markush group set forth therein can be considered to be hydrides because they also lack atomic hydrogen in their chemical composition.

- c) Claim 18 does not particularly point out and distinctly set forth how the recitation that the chemical hydride is in the form of a solution further limits the claimed system. In other words, the chemical hydride is in the form of a solution as a consequence of a method step, but this method step does not further limit the claimed system. There are no specific limitations in either claims 1 or 18 that water be added to the chemical hydride to form a solution of the chemical hydride, but the claim raises the question of whether or not this is a consequence of adding the aqueous solution of claim 8 to the chemical hydride of claim 1. The claim language suggests that the chemical hydride be initially put into the compartment in the form of an aqueous solution prior to the generation of hydrogen gas, but this does not appear to be the applicants' intention. Lastly, adding water to the chemical hydride would not appear to produce a solution of chemical hydride, but rather hydrogen gas and some other chemical compound.
- d) Claim 39 does not particularly point out and distinctly set forth if the solution of chemical hydride set forth is a consequence of adding the water to the solid chemical hydride to produce hydrogen gas and some other chemical compound, or if the applicants simply insert a solution of chemical hydride into the compartment prior to the generation of hydrogen gas as suggested by claim 39 (but this doesn't appear to be the applicants' intention). If you add water to the chemical hydride it would not seem that

you would produce a solution of chemical hydride (but of some other chemical compound).

e) In claims 19 and 36, did the applicants really intend to recite ammonia (i. e. $\text{NH}_3(\text{gas})$) or ammonium hydroxide (i. e. $\text{NH}_4\text{OH}(\text{aq.})$).

f) Claim 22 does not particularly point out and distinctly set forth if the "second compartment" set forth in claim 22 is the same or different from the "second compartment" set forth in claims 9 and 17.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1, 2, 3, 6, 7, 8, 10, 11, 12, 13, 17, 18, 19, 20, 21, 22, 24, 25, 28, 32, 33, 34, 35, 36, 38, 39, 40 and 41 are rejected under 35 U.S.C. 102(a) as being anticipated by U. S. Patent Application Publication No. US 2002/0081235 A1 to Baldwin et al.

Figure 1 and the description of figure 1 set forth on pg. 3, paragraph no's. 0039-0042 illustrate a method and apparatus for producing hydrogen gas from the reaction between a metal hydride and an aqueous solution, comprising:

Providing a water tank (1);

Providing a reactor (5) containing aluminum nuggets and sodium hydroxide powder: please see pg. 3, paragraph no. 0039;

Spraying water into the reactor (5) where the water reacts with the sodium hydroxide powder to produce a solution of sodium hydroxide, this solution of sodium hydroxide reacts with the aluminum nuggets to produce hydrogen gas and sodium-aluminum hydroxide by-product: please see pg. 3, paragraph no. 0039;

Passing the resulting hydrogen gas through a condenser (6), where evidently the condenser (6) condenses out any water in the hydrogen gas, and

Passing the resulting, dry hydrogen gas into a hydrogen storage tank (7), as set forth in applicants' claims 1, 2, 3, 6, 7, 8, 10, 11, 12, 13, 17, 18, 19, 20, 21, 22, 24, 25, 28, 32, 33, 34, 35, 36, 38, 39, 40 and 41.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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The person having ordinary skill in the art has the capability of understanding the scientific and engineering principles applicable to the claimed invention. The references of record in this application reasonably reflect this level of skill.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-13, 17-25, 28-30 and 32-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent Application Publication No. US 2002/0081235 A1 to Baldwin et al.

Figure 1 and the description of figure 1 set forth on pg. 3, paragraph no's. 0039-0042 illustrate a method and apparatus for producing hydrogen gas from the reaction between a metal hydride and an aqueous solution, comprising:

Providing a water tank (1);

Providing a reactor (5) containing aluminum nuggets and sodium hydroxide powder: please see pg. 3, paragraph no. 0039;

Spraying water into the reactor (5) where the water reacts with the sodium hydroxide powder to produce a solution of sodium hydroxide, this solution of sodium

hydroxide reacts with the aluminum nuggets to produce hydrogen gas and sodium-aluminum hydroxide by-product: please see pg. 3, paragraph no. 0039;

Passing the resulting hydrogen gas through a condenser (6), where evidently the condenser (6) condenses out any water in the hydrogen gas, and

Passing the resulting, dry hydrogen gas into a hydrogen storage tank (7), as set forth in applicants' claims 1, 2, 3, 6, 7, 8, 10, 11, 12, 13, 17, 18, 19, 20, 21, 22, 24, 25, 28, 32, 33, 34, 35, 36, 38, 39, 40 and 41.

The difference between the applicants' claims and the Baldwin et al. reference is that applicants' claims 4, 5, 29 and 30 call for the use of a desiccant (evidently, to sorb water out of the hydrogen gas in the same manner that the condenser (6) dewateres the hydrogen gas, as illustrated in figure 1 in the Baldwin et al. reference), however it would have been obvious to one of ordinary skill in the art at the time the invention was made *to modify* the Baldwin et al. process and apparatus *by substituting* the water-sorbing desiccants of applicants' claims 4, 5, 29 and 30 *in lieu of* the water-removing condenser (6) illustrated in figure 1 in the Baldwin et al. reference *because* the courts have already determined that such substitution of functional equivalents within a process is *prima facie* obvious: please see the discussion of the *In re Fout* 675 F.2d 297, 213 USPQ 532 (CCPA 1982) court decision set forth in section 2144.06 in the MPEP (Rev. 3, Aug. 2005).

The difference between the applicants' claims and the Baldwin et al. reference is that applicants' claims 9 and 23 set forth that the first and second compartments are disposed within a single container, however it is submitted that this difference would

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have been obvious to one of ordinary skill in the art at the time the invention was made because of the expected advantage of saving space by housing the first and second compartments within the same container, rather than no containers at all or separate containers. Expected advantages are evidence of obviousness.

The difference between the applicants' claims and the Baldwin et al. reference is that applicants' claim 37 sets forth that the chemical hydride is heated, however it is submitted that this difference would have been obvious to one of ordinary skill in the art at the time the invention was made because of the expected advantage of the heat to promote the reaction between the water or aqueous solution and the metal hydride to produce hydrogen gas.

Claims 14, 15, 26 and 27 have not been rejected under either 35USC102 or 35USC103 because the Baldwin et al. reference does not teach or suggest that the hydrogen storage canister contains a metal hydride of the formula AB, AB₂ or AB₅.

Claims 16 and 31 have not been rejected under either 35USC102 or 35USC103 because the Baldwin et al. reference does not teach or suggest that a heat exchanger be in thermal contact with the hydrogen storage canister.

The following references, which are indicative of the state of the art, are made of record:

U. S. Patent 6,358,488 B1 disclosing a method for generating hydrogen;

U. S. Patent 6,638,493 B2 disclosing a method for producing hydrogen;

U. S. Patent 6,866,836 B2 disclosing a method for generating hydrogen from borohydrides and water;

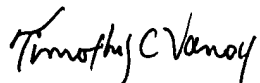
U. S. Patent 6,939,529 B2 disclosing a self-regulating hydrogen generator, and

U. S. Patent Application Publication US 2001/0022960 A1 disclosing a hydrogen generating method.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy C. Vanoy whose telephone number is 571-272-8158. The examiner can normally be reached on Mon-Fri 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Timothy C Vanoy
Patent Examiner
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